

This invention provides a unique solution to the vexing problems of breakage of acceptable chips and of obtaining sufficient deceleration in a short space. FIG. 2 is a schematic illustration of the invention. The inspection conveyor 10, air reject module 12 and air nozzle means (multiple nozzles) 14 are the same as in the prior art visual inspection machine described above. Similarly, the path of the trajectory of the acceptable chips and rejected chips is the same as FIG. 1 and the same reference numbers are used to indicate the same. The feature of this invention is a chute 22 which is generally "S"-shaped and having a variable slope. The chute is fixedly mounted by suitable mounting means schematically illustrated at 24 and is positioned so that an upper end 26 of the "S"-shaped chute bottom is underneath the path of the acceptable chips and out of the path of the rejected chips. A generally flat central portion 28 of the chute is positioned so as to create a minimum, i.e., very small, impact angle 29. The impact angle is the angle between the chute portion 28 and the end of the trajectory of acceptable chips where they impact the chute. The optimum impact angle should be as close to 0° as possible, and in any event should be less than about 20°. The central portion 28 of the chute is almost parallel to the path of the acceptable chips so that on impact the acceptable chips do not hit at a large angle but rather slide down the portion 28 of the chute. Below the portion 28 is a portion 30 where the slope of the chute changes and the variable slope between these portions has the effect of decelerating the chips. The chips continue their path on a portion 32 at the bottom of the chute which is preferably and generally approximately horizontal. The chute allows the speed of the acceptable chips to decelerate (e.g., from 350-380 feet per minute) to the final speed at the exit of the chute (approximately 100 feet per minute). The chips then pass on to another conveyor for appropriate further processing.

The chips which are thrown off of the inspection conveyor travel in flight in space toward the chute 22 at an approximate parabolic trajectory. The portion of the chute where the chips first make contact, section 28, is steeply sloped to match the flight angle of the chips. By maintaining a small impact angle 29 the chute allows the chips to land smoothly and with minimum breakage. As the chips slide down the chute they encounter a decreasing slope on the chute, and because of the smaller slope at the discharge end of the chute the chips are slowed down considerably from the initial speed. The slower product speed allows the chips to transfer from the chute into any subsequent equipment with minimum breakage.

In tests on production equipment, by way of a non-limiting example, a product flow of between 1250-1500 pounds per hour was run through an OPTI-SORT inspection machine and left the inspection conveyor at about 380 feet per minute. The chips were decelerated by the chute alone to about 150 feet per minute. With the air reject system enabled, product breakage was as low as 0.15%. The top of the "S"-shaped chute was 3½ inches below the top of the inspection conveyor and 6½ inches from the end of the inspection belt with the steeply shaped portion of the chute at an angle of 45°.

FIG. 3 shows the use of the "S"-shaped chute for the infeed of the inspection conveyor 10. At the entrance end of the inspection machine the chips are traveling in a bed 2-3 chips deep on an infeed conveyor 34 which is positioned above and spaced from the inspection con-

veyor 10. Typically the inspection conveyor 10 is traveling at 2-3 times the speed of the infeed conveyor so that the chips which are 2-3 chips deep on the infeed conveyor are monolayered (formed in a single layer) on the inspection conveyor. The vision inspection system operates best when inspecting a monolayer of chips without clumps. As non-limiting examples, the infeed conveyor may be traveling at 100-150 feet per minute and the inspection conveyor is traveling at 350-400 feet per minute.

An "S"-shaped infeed chute 36 is provided between conveyors 34 and 10 as shown in FIG. 3. The chute 36 has portion 38 to receive the chips thrown off the end of the conveyor 34 at a minimum impact angle. The chips then slide down a central portion 40 of the "S"-shaped chute 36 and into a short transition length 42. The transition length is short to avoid decelerating the chips prior to entering the high speed inspection conveyor 10. The chips spread out during their fall onto portion 38 of the chute 36. In addition to reducing chip breakage, the infeed chute 36 has the added benefit of spreading out the chips coming from the layered bed of chips on conveyor 34 and preventing the formation of clumps of chips which would interfere with the vision inspection system.

As can be seen, this invention discloses an extremely simple but highly effective means for preventing breakage of chips normally associated with high speed inspection. It also allows quick and efficient control of deceleration of such chips in a relatively short while eliminating the problems of the prior art.

Although the invention is described with regard to the preferred embodiment, namely, potato chips, there is no reason that it would not also be applicable to similar lightweight fragile articles.

We claim:

1. In combination with a sorting machine for sorting lightweight fragile items having a large surface area, a sorting machine having an inspection conveyor traveling at a high speed on which items are inspected by inspection means and then thrown from the end of the conveyor into space, air nozzle rejected item selection means for separation of acceptable items from rejected items operative from the inspection means to direct a blast of air against rejected items to change their trajectory after being ejected from the end of the inspection conveyor, with improved receiving means for receiving acceptable items to minimize breakage and to decelerate the speed of the acceptable items, the receiving means comprising:

- a stationary chute having a generally "S" shape with a variable slope between the top and the lower portion of the "S",
- means supporting the chute spaced from and below the end of the conveyor so as to be in the trajectory of acceptable items and out of the trajectory of rejected items,
- means positioning the chute so that an intermediate portion of the variable slope presents a minimum impact angle to the path of acceptable items,
- the lower portion of the bottom of the "S"-shaped chute shaped in a generally horizontal line to allow efficient removal of the accepted items.

2. A device as defined in claim 1 wherein the impact angle of said chute is less than about 20°.

3. In combination with a sorting machine for sorting lightweight fragile items having a large surface area, a sorting machine having an inspection conveyor travel-